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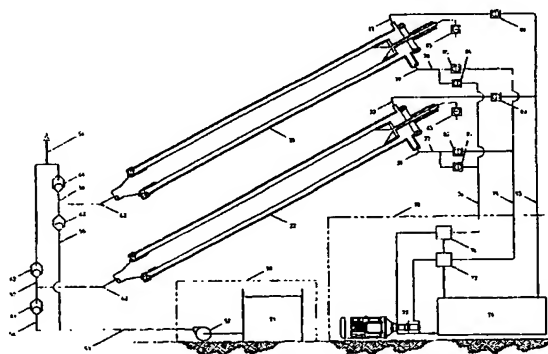
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- (71) Applicant (*for all designated States except US*): COMBINED RESOURCE ENGINEERING PTY LTD [AU/AU]; Unit 9, 12 - 14 Thelma Street, West Perth, Western Australia 6005 (AU).
- (72) Inventors; and
- (75) Inventors/Applicants (*for US only*): MORRISS, Gordon, Leith [AU/AU]; 408 Dewey Street, Shelley, Western Australia 6148 (AU). WEST, Robert, Leslie [AU/AU]; 115 Excelsior Retreat, Hillarys, Western Australia 6025 (AU).
- Published:
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(54) Title: FLUID OPERATED PUMP



(57) Abstract: A pumping system comprising a pump (21) for conveying a pumped fluid using an actuating fluid. The pump comprising a rigid outer casing (25) defining an interior space (26), a tube structure (27) accommodated in the interior space (26), the tube structure (27) being flexible and substantially inelastic. The interior of the tube structure (27) defines a pumping chamber (28) for receiving pumped fluid. The tube structure (27) is movable between laterally expanded and collapsed conditions for varying the volume of the pumping chamber (28) thereby to provide discharge and intake strokes. The region of the interior space (26) surrounding the tube structure (27) defines an actuating region for receiving and accommodating actuating fluid. The pumping chamber (28) is adapted to receive pumped fluid to cause the tube structure (27) to move towards the expanded condition and the pumping chamber (28) thereby undergoing an intake stroke. The pumping chamber (28) undergoes a discharge stroke upon collapsing of the tube structure (27) in response to the action of actuating fluid in the actuating region. The pumping system also comprises a delivery means (50) for delivering pumped fluid to the pumping chamber (28) in timed sequence for causing the pumping chamber (28) to undergo an intake stroke, and means (70) for supplying actuating fluid to the actuating region in timed sequence to cause the tube structure (27) to laterally collapse whereby the pumping chamber (28) undergoes a discharge stroke.

WO 2004/011806 A1

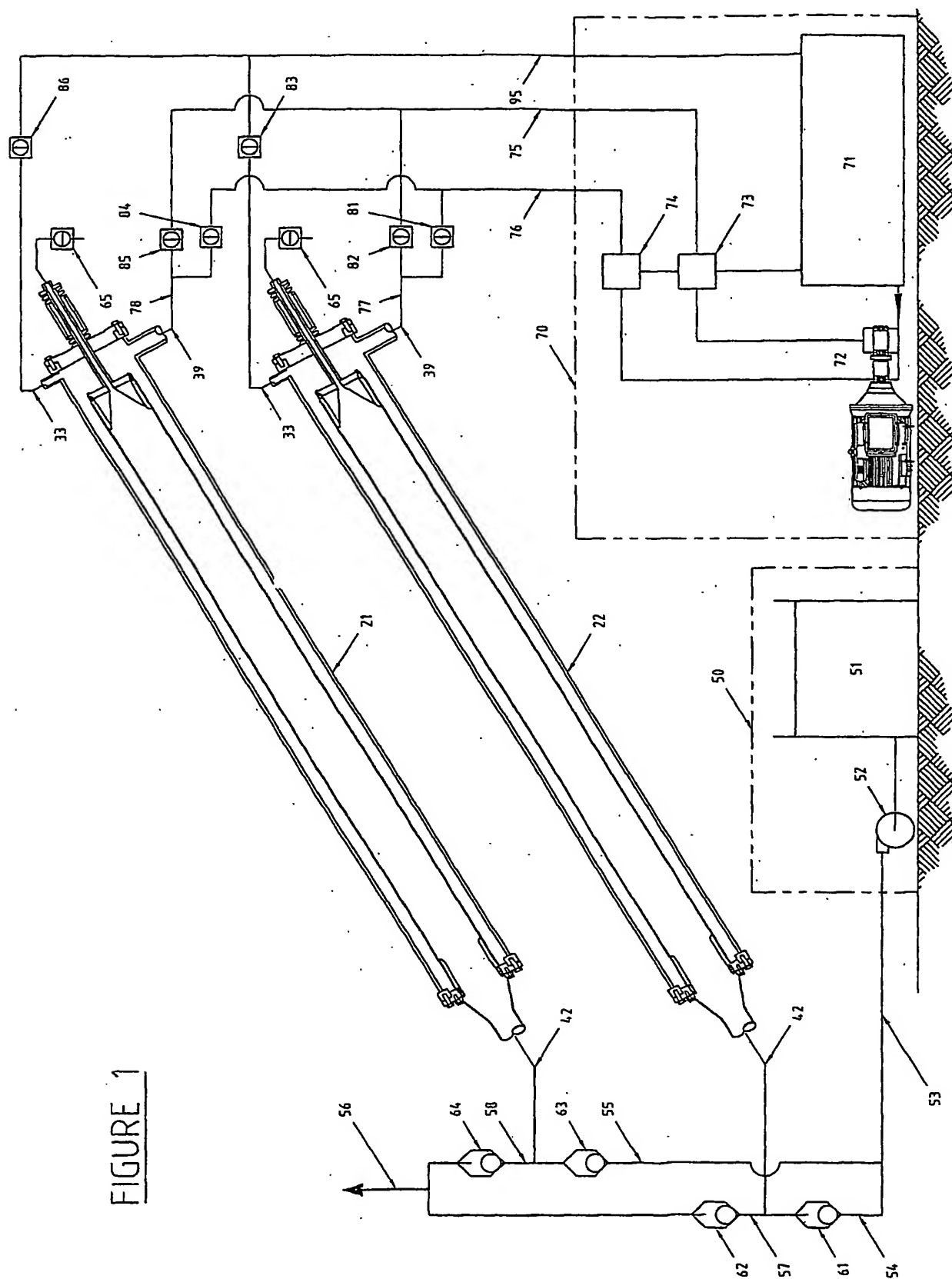
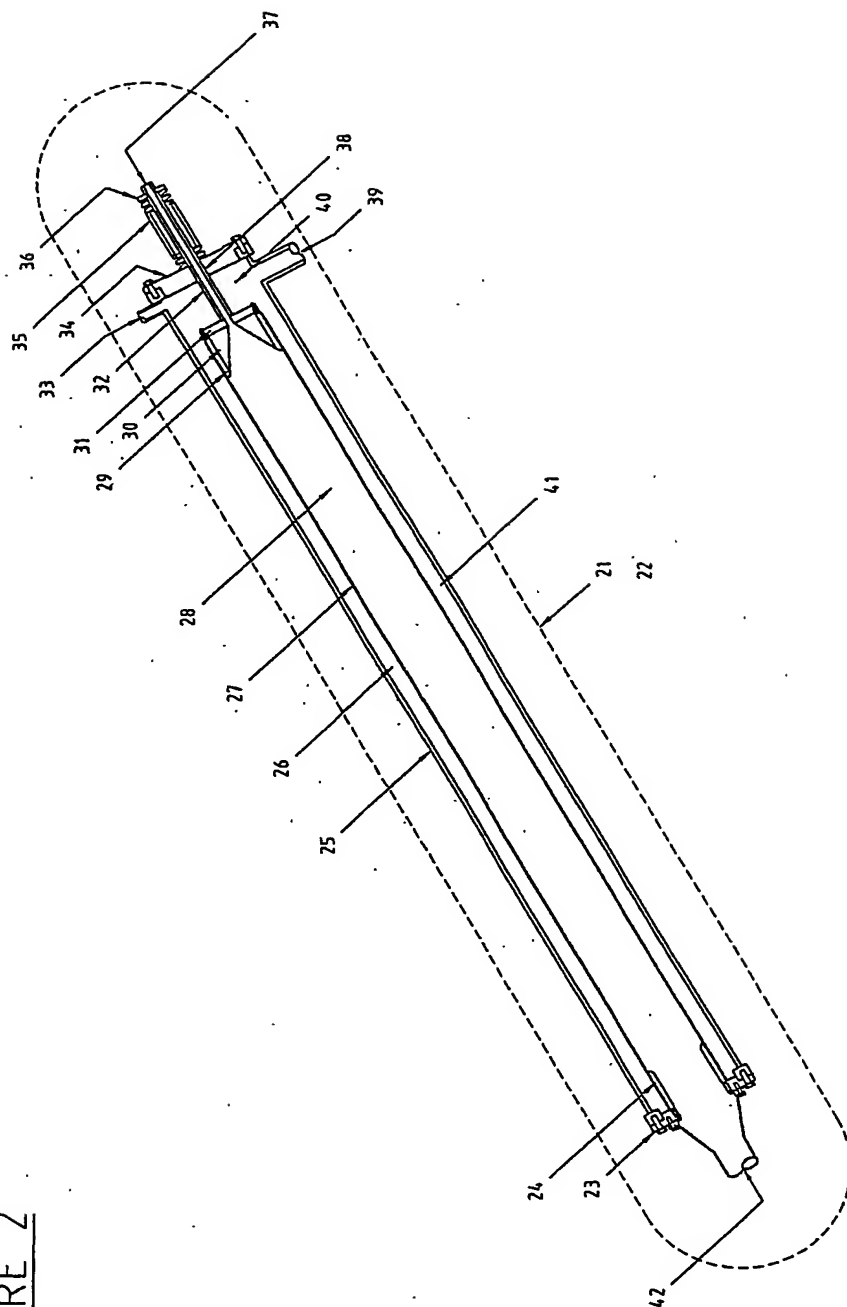


FIGURE 1

FIGURE 2

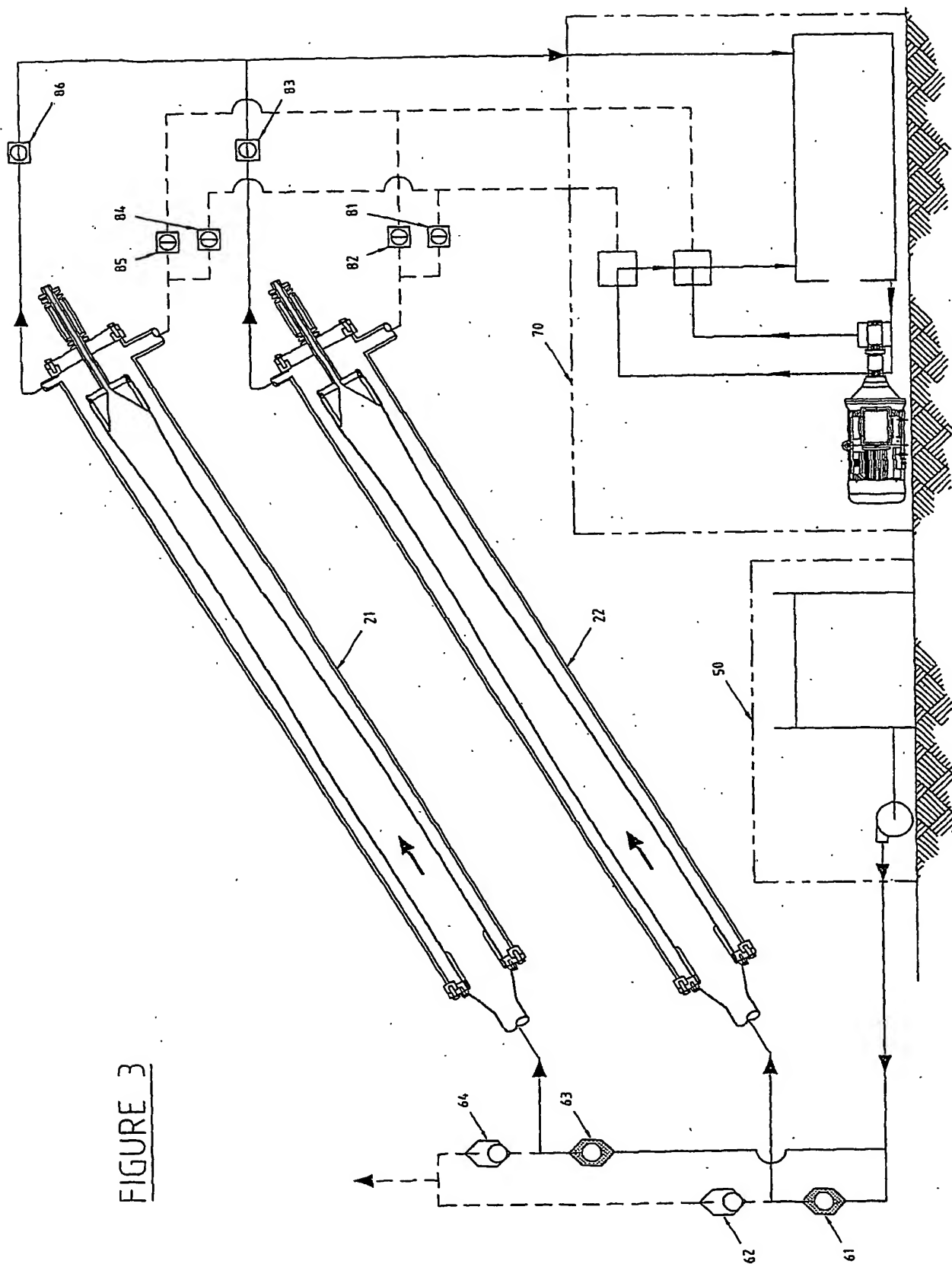


FIGURE 3

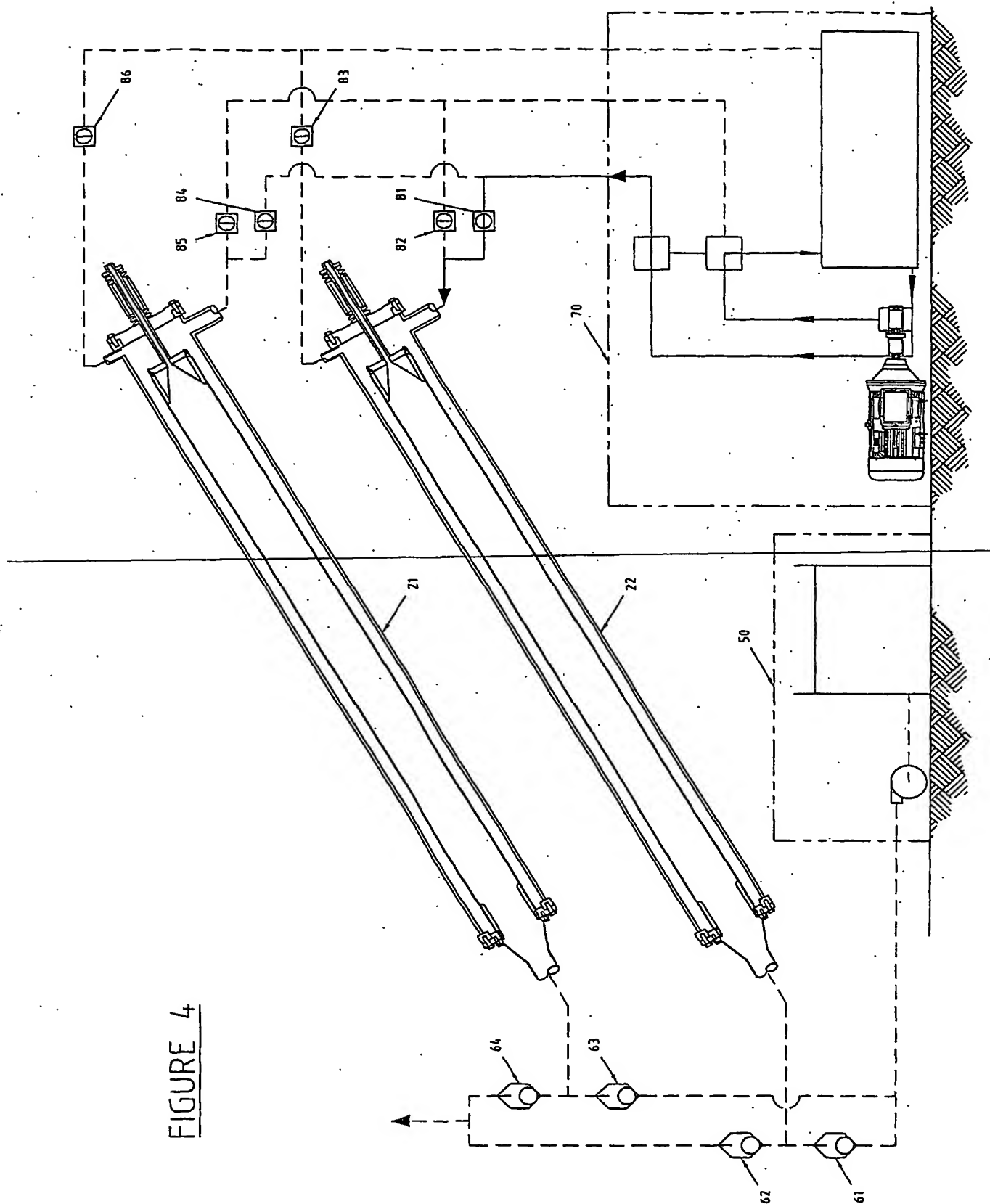


FIGURE 4

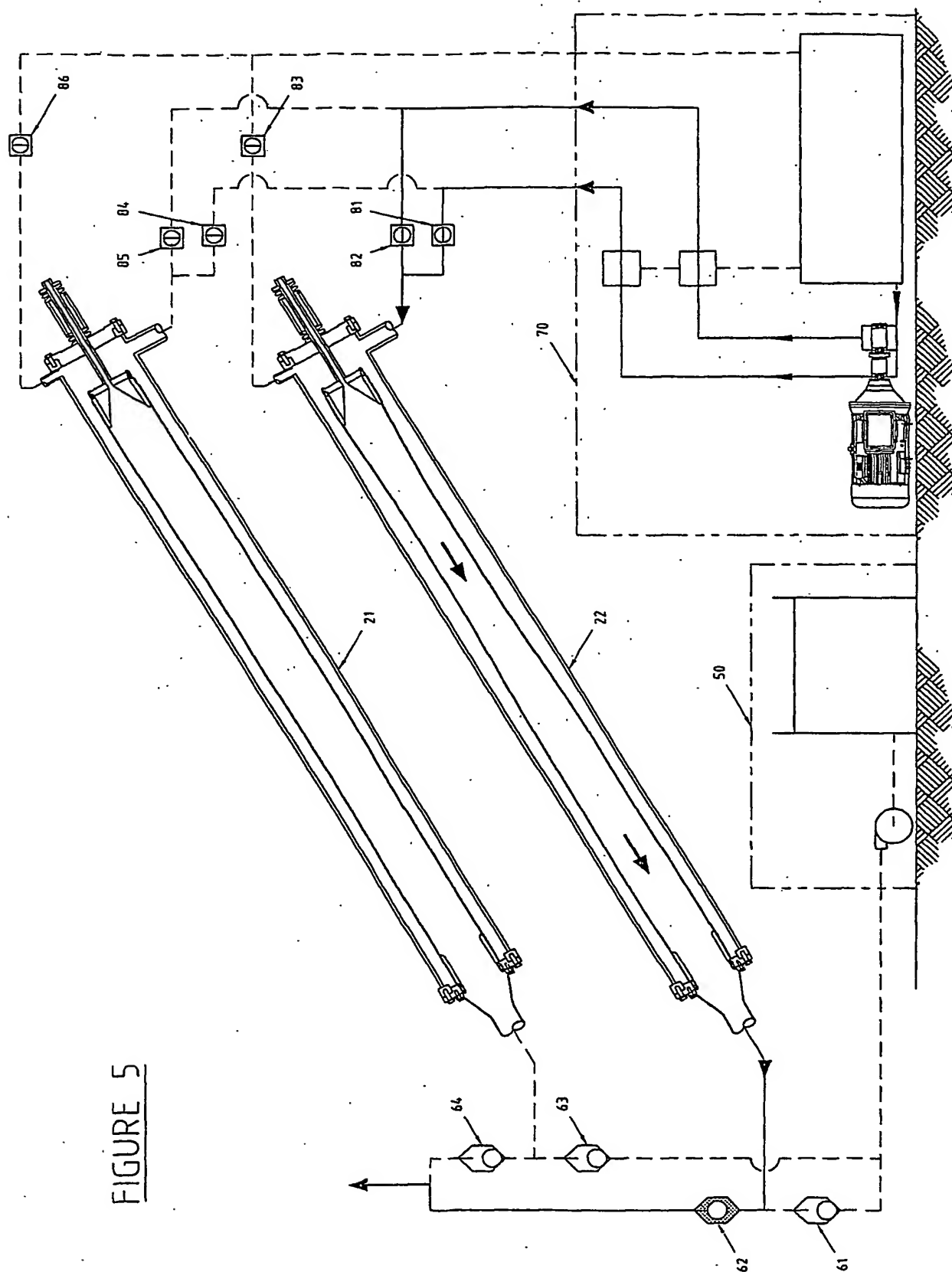


FIGURE 5

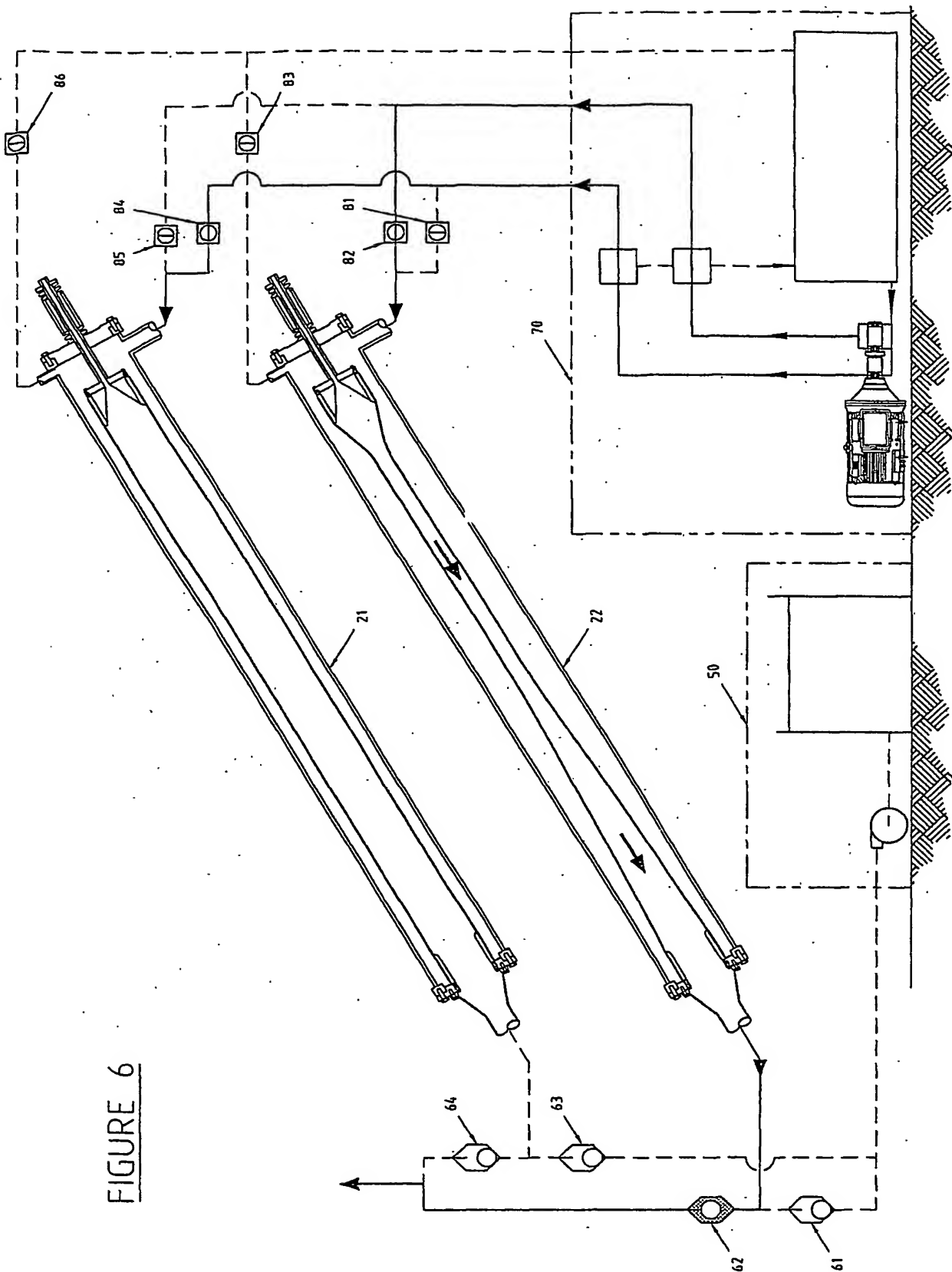


FIGURE 6

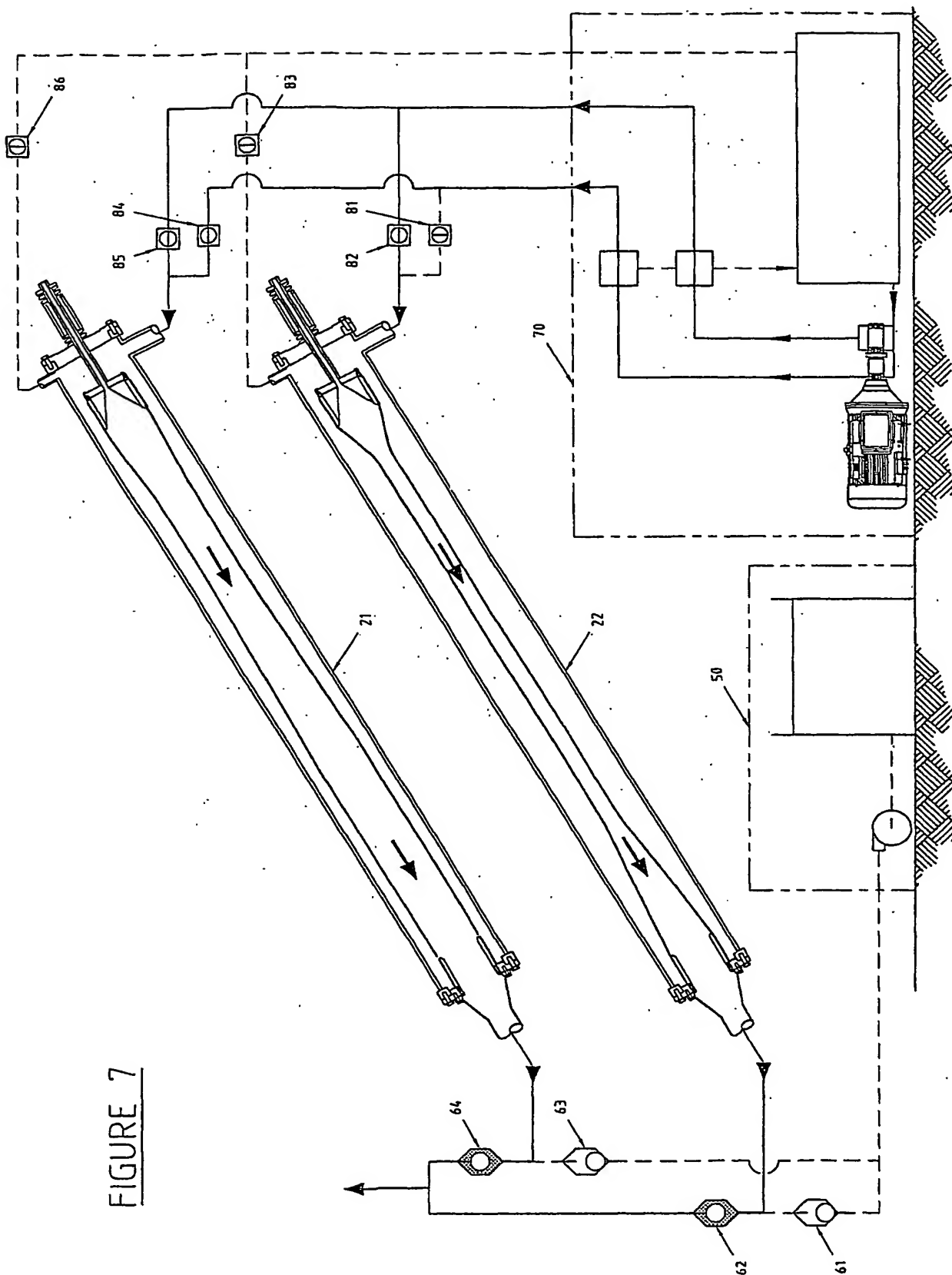


FIGURE 7

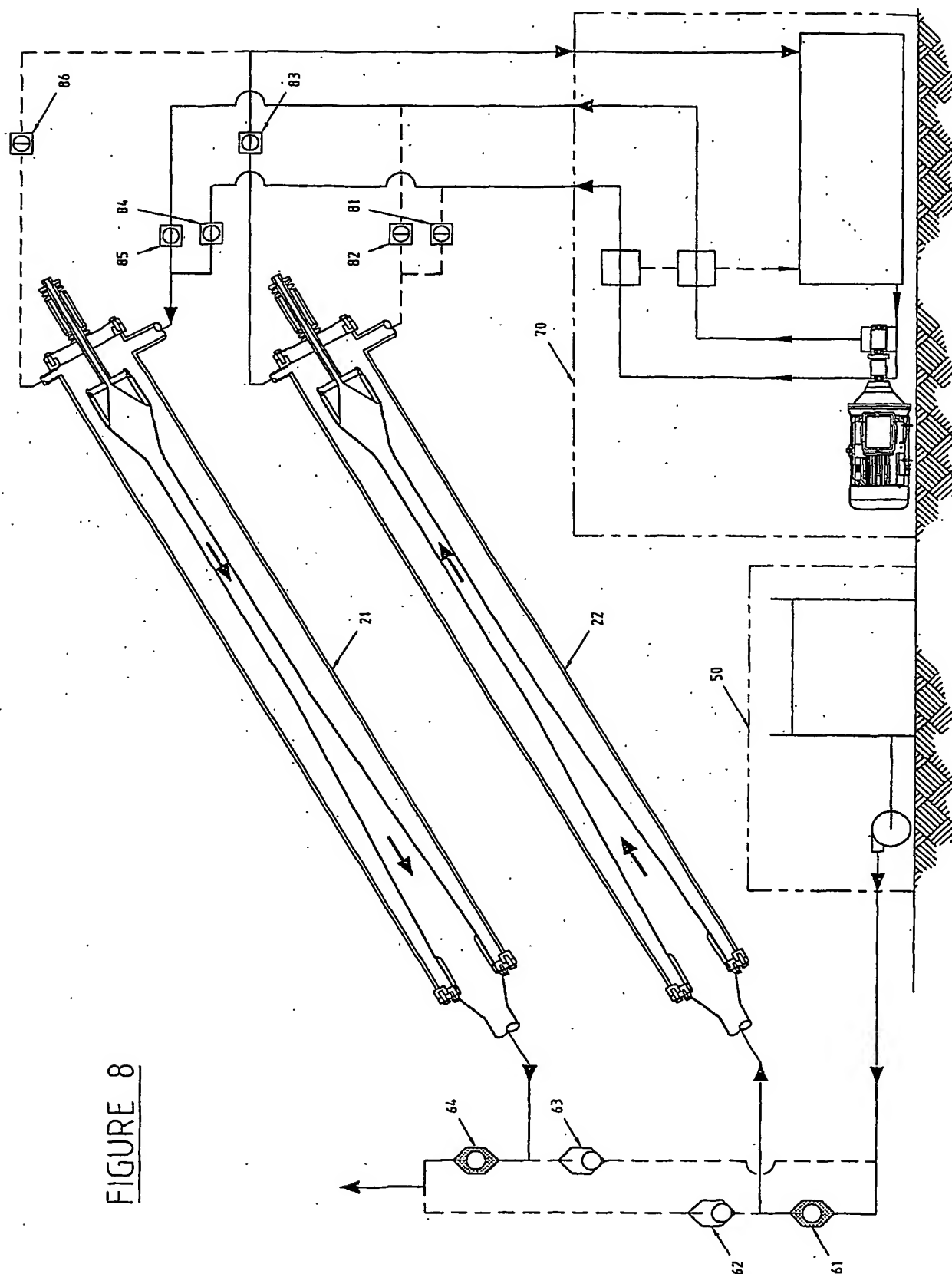


FIGURE 8

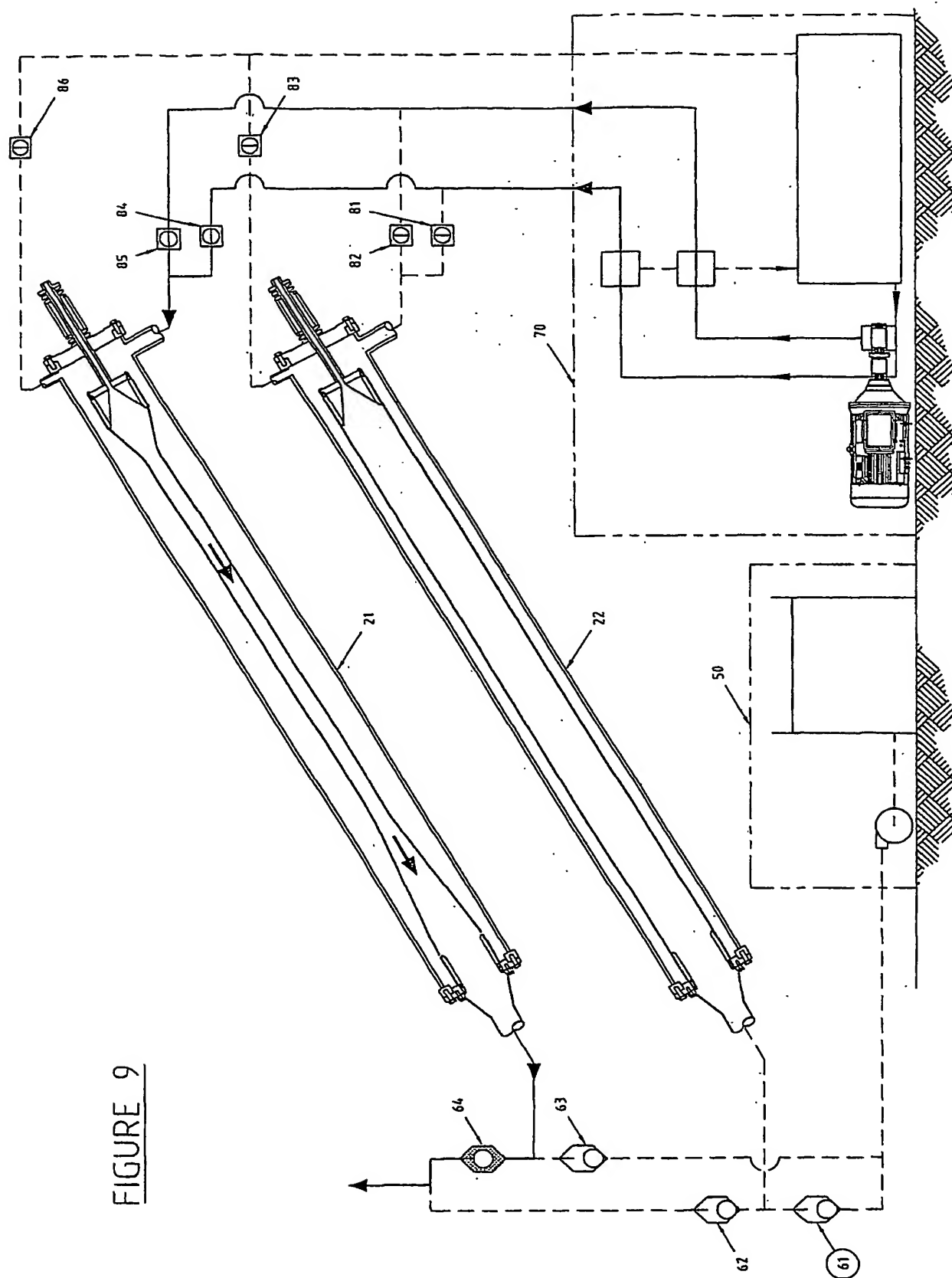


FIGURE 9

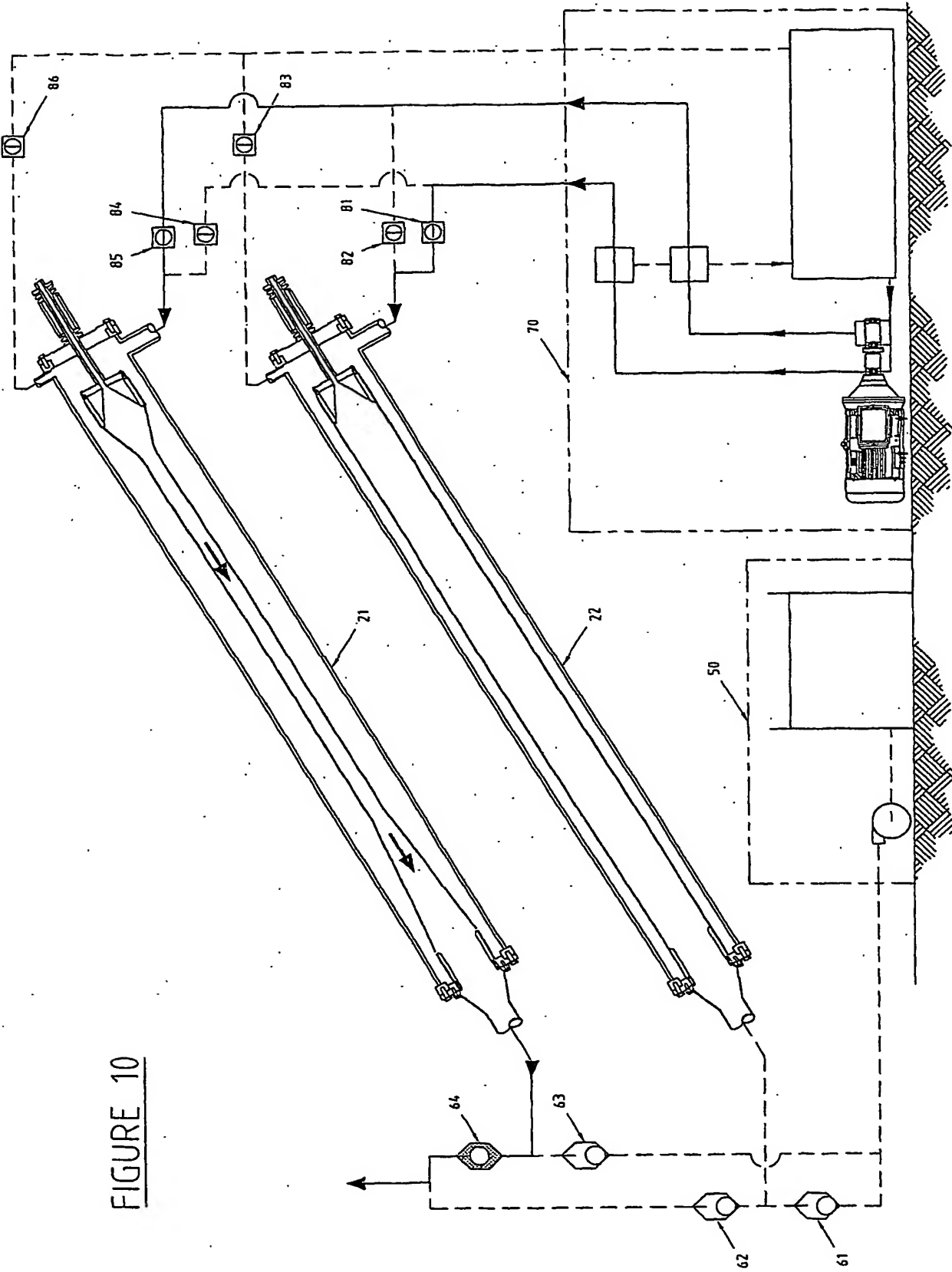


FIGURE 10

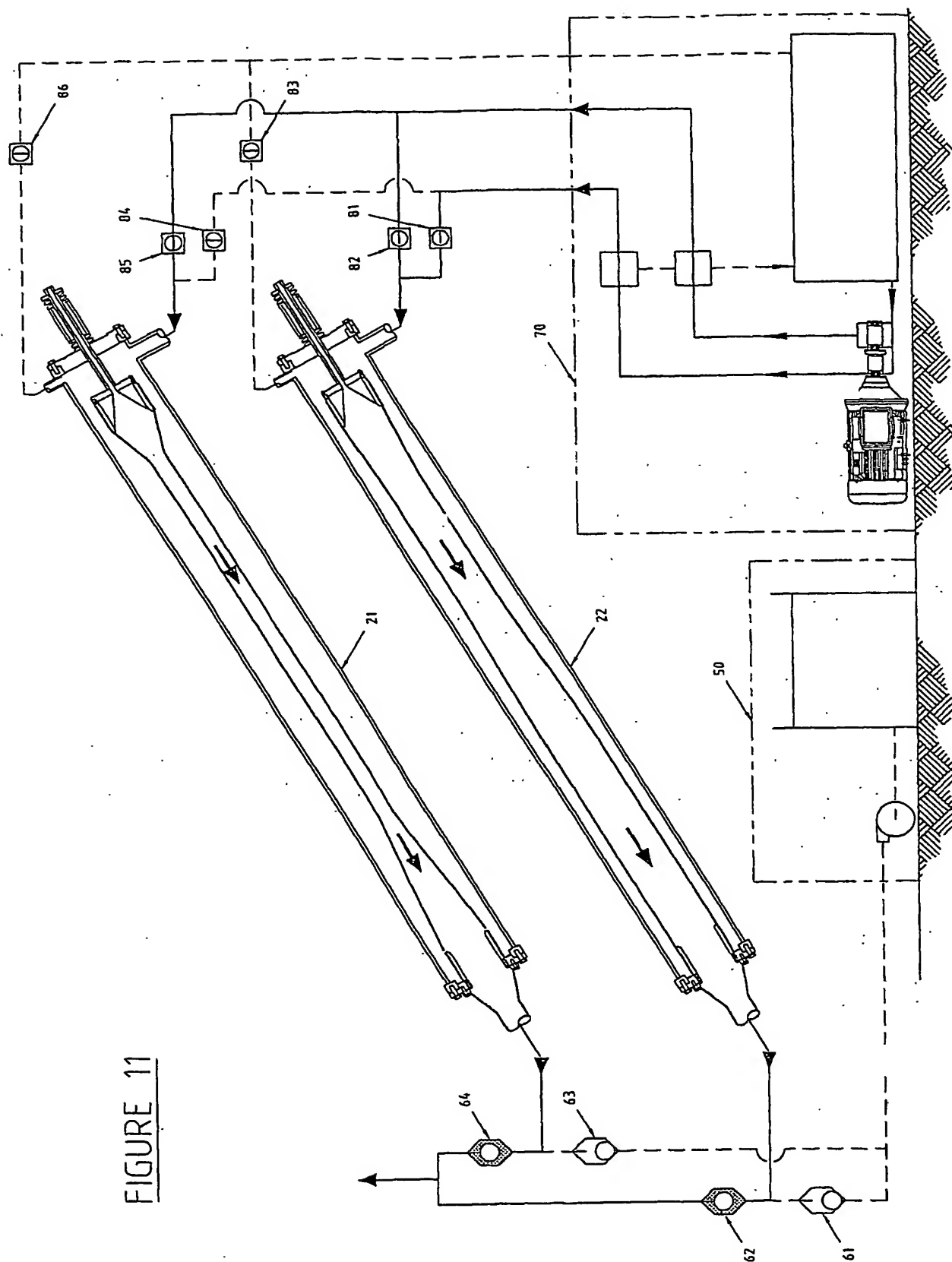


FIGURE 11

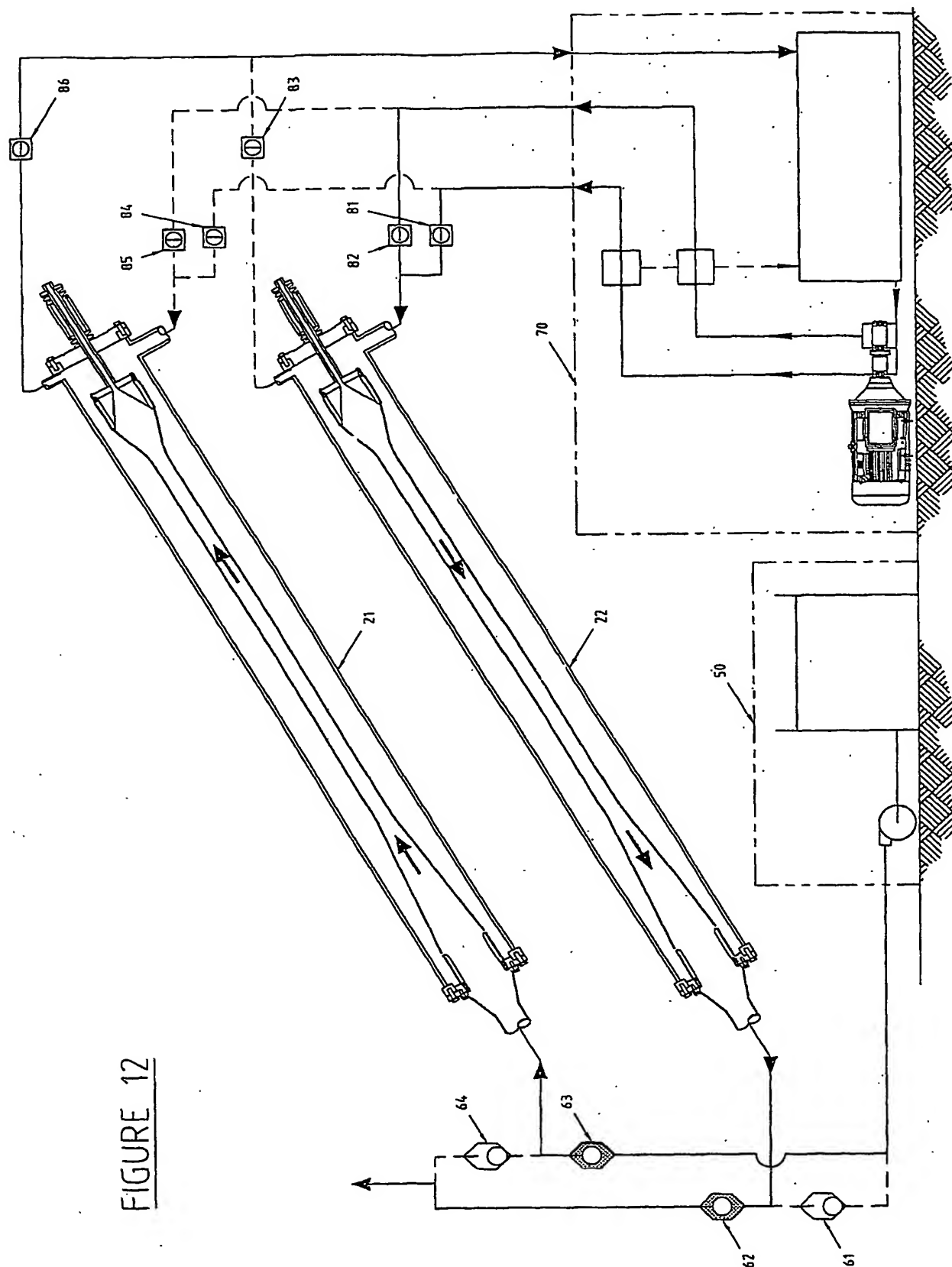


FIGURE 12

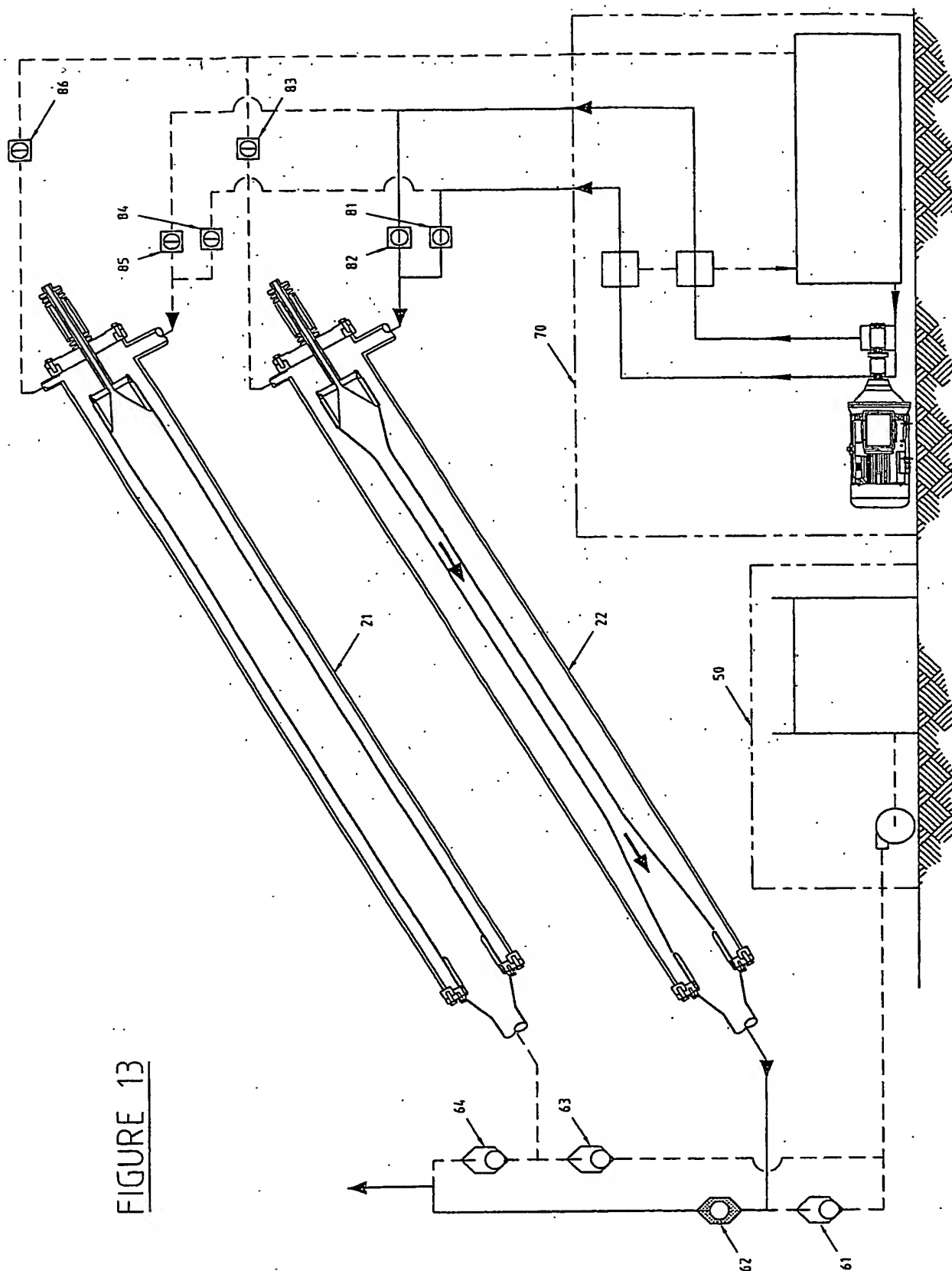


FIGURE 13

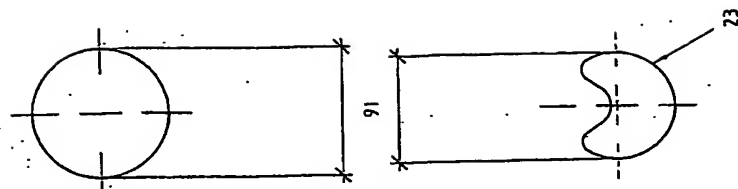


FIGURE 15

FIGURE 17

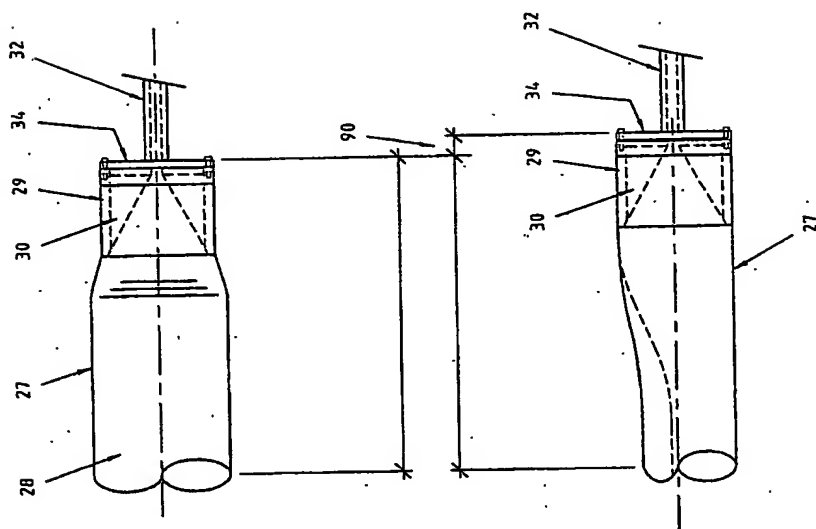


FIGURE 14

FIGURE 16

FIGURE 18

CHAMBER 21					CHAMBER 22				
Reference	Valve 84	Valve 85	Valve 86	Description	Valve 84	Valve 85	Valve 86	Description	
Figure 3	Closed	Closed	OPEN	Tube 27 fills, fluid in the Chambers 40, 41 returns to tank until the Tube is FULL	Closed	Closed	OPEN	Tube 27 fills, fluid in the Chambers 40, 41 returns to tank until the Tube is FULL	
Control system Instrumentation must confirm the Tube 27 FULL status before proceeding to the next step									
Figure 4	Closed	Closed	Closed	Tube 27 remains FULL	OPEN	Closed	Closed	Chamber 40, 41 is pressurised to the system operating pressure	
Figure 5	Closed	Closed	Closed	Tube 27 remains FULL	OPEN	OPEN	Closed	Pump stroke commences	
Figure 6	OPEN	Closed	Closed	Chamber 40, 41 is pressurised to the system operating pressure	Closed	OPEN	Closed	Pump stroke continues	
Figure 7	OPEN	OPEN	Closed	Pump stroke commences	Closed	OPEN	Closed	Pump stroke finishing	
Figure 8	OPEN	OPEN	Closed	Pump stroke continues	Closed	Closed	OPEN	Tube 27 starts filling and fluid in Chambers 40, 41 returns to tank	
Figure 9	OPEN	OPEN	Closed	Pump stroke continues	Closed	Closed	Closed	Tube 27 is FULL , control system instrumentation must confirm FULL Tube status before proceeding to the next step	
Figure 10	Closed	OPEN	Closed	Pump stroke continues	OPEN	Closed	Closed	Chambers 40, 41 is pressurised to the system operating pressure	
Figure 11	Closed	OPEN	Closed	Pump stroke finishing	OPEN	OPEN	Closed	Pump stroke commences	
Figure 12	Closed	Closed	OPEN	Tube 27 starts filling and fluid in Chambers 40, 41 returns to tank	OPEN	OPEN	Closed	Pump stroke continues	
Figure 13	Closed	Closed	Closed	Tube 27 is FULL , control system Instrumentation must confirm FULL Tube status before proceeding to the next step	OPEN	OPEN	Closed	Pump stroke continues	
Sequence repeats from Figure 6									
Figure 6	OPEN	Closed	Closed	Chambers 40, 41 is pressurised to the system operating pressure	Closed	OPEN	Closed	Pump stroke continues	
Figure 7	OPEN	OPEN	Closed	Pump stroke commences	Closed	OPEN	Closed	Pump stroke finishing	
Figure 8	OPEN	OPEN	Closed	Pump stroke continues	Closed	Closed	OPEN	Tube 27 starts filling and fluid in Chambers 40, 41 returns to tank	
Figure 9	OPEN	OPEN	Closed	Pump stroke continues	Closed	Closed	Closed	Tube 27 is FULL , control system Instrumentation must confirm FULL Tube status before proceeding to the next step	

INTERNATIONAL SEARCH REPORT

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PCT/AU03/00953

A. CLASSIFICATION OF SUBJECT MATTER		
Int. Cl. ⁷ : F04B 43/10, 43/113		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
Refer electronic database consulted below		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
DWPI - F04B 43/08, 43/10, 43/107, 43/113, 15/02 and keywords expand, collapse and similar terms		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2195149 A (S B SERVICES (PNEUMATICS) LTD) 30 March 1988 Whole document	1,4,10-16,48
X Y	WO 82/01738 A1 (RIHA) 27 May 1982 Page 12, line 37- page 14, line 15 & figures	1,4,10-16,48 2,5-9,17-24,27-32,35-36,49-50
Y	US 6345962 B1 (SUTTER) 12 February 2002 Whole document	2,8-9,35-36,40
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Date of the actual completion of the international search 28 August 2003		Date of mailing of the international search report 5 SEP 2003
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929		Authorized officer R. SUBBARAYAN Telephone No : (02) 6283 2377

INTERNATIONAL SEARCH REPORT

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 5897530 A (JACKSON) 27 April 1999	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU03/00953

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
GB	2195149	NONE			
WO	8201738	AU	77737/81	EP	73196
US	6345962	NONE			
US	4543044	AU	35155/84	CA	1224082
		FR	2554515	IN	161834
		ZA	8408740	ZW	203/84
US	5114319	EP	422745	JP	3185276
US	4257751	NONE			
US	4886432	NONE			
US	5897530	EP	944405	WO	9933503
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